Review of Language Origins

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Book reviews

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Maggie Tallerman (Ed.): Language origins: perspectives on evolution (Studies in the evolution of language). Oxford University Press (Oxford, England), 2005, 448 pp, H/b US $125.00, S/b US $45.00

Maeve Paris

Language Origins is the fourth in a series of studies in the evolution of language, offering a cross-section of work based on papers originally presented at the fourth International Conference on the Evolution of Language at Harvard University in 2002. It is a substantial volume aimed at a broad readership: seventeen chapters are assembled into four themes dealing with the evolution of speech and speech sounds; the evolution of grammar; analogous and homologous traits in other species; and learnability and diversity. This choice of themes is an indication of the multidisciplinary nature of research into the origins and evolution of language, and the contributors are drawn from many fields including linguistics, neuroscience, psychology, biology, and computer science. The text as a whole is intended to present a cross-disciplinary perspective on what the editor considers to be a rapidly developing field, captured at an important moment in its evolution: this is a young field whose terms of reference are still under construction.

There are central assumptions which unite the authors: all accept that language did evolve, that natural selection was a driving force in the emergence of language, that the emergence of language was influenced by factors which have parallels elsewhere in the natural world, and that the structure of language is directly relevant to questions about its evolution.

Given the range of this volume, the scope of its potential readership, and the cross-disciplinary nature of the contributions, there are significant editorial challenges to which Maggie Tallerman has risen, through the provision of a clear introduction to the volume which attempts to unite the various themes and capture the field of study at this stage of its development; in addition, each of the themes benefits from a significant introduction which

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cites the theme in an overall context as well as cross-referencing the other themes. Such an approach is necessary if the volume is to appeal to its intended readership ('linguists, cognitive scientists, biologists, psychologists, neuroscientists, and experts in artificial intelligence, as well as all those fascinated by the issues, puzzles, and problems raised by the evolution of language').

The first theme relates to speech and considers how links between perception and production emerged for spoken language. Arbib offers an answer (in punchy, direct prose) in the shape of a heuristic framework based on comparative biology, the 'Mirror System Hypothesis'; Studdert-Kennedy uses articulatory phonology theory to argue that the gesture is the dynamic unit of action from which consonants and vowels are formed; Oudeyer uses computer simulation to consider how phonetic properties emerged 'from scratch'; and de Boer ponders on the stability of vowel systems across generations.

From a consideration of speech, the volume then turns to grammar. Tallerman focuses on syntax and the neo-Darwinian concept of exaptation, taking apart recent work by Andrew Carstairs-McCarthy which claims that the structure of the clause was exapted from the syllable. Tallerman concludes that in fact, structural similarities between the syllable and the clause are superficial. McDaniel looks at protolanguage, to consider why constituents can be displaced in all languages (the concept of movement). Carstairs-McCarthy himself is given the floor in the subsequent chapter, moving away from the syllable to the evolution of morphology, in an attempt to discover why most languages appear to need both morphology and syntax, and suggesting the answer lies in protolanguage, where adjacent 'words' must have influenced each other phonologically. Comrie and Kuteva are also concerned with protolanguage and the evolution of grammatical categories and constructions, concluding that some languages maintain complex grammatical systems for social and cultural reasons. Finally, Franks and Rigby assert that the use of language was a method of honest signalling used to select a mate, and that exaptation again plays a role, where linguistically creative individuals are more attractive to potential mates.

Part three considers research into animal communication and grapples with the difficulty of identifying just what makes human language special. Pepperberg offers an avian perspective on language evolution, while Zuberbuhler draws comparisons from the primate world to show that certain basic linguistic capabilities are present in non-human primates.

The final section leads the reader into the future of language evolution research and in particular the role of computer modelling in this future, where the advent of high-speed computing has opened up all kinds of possible opportunities. Brighton et al. offer a theoretical introduction to the four studies involving computational simulations of agents communicating with other agents leading to the construction of a language. Each chapter deals with simulated populations of agents from a different perspective: co-evolution (Briscoe), quasi-regular languages (Roberts et al.), language diversity (Solan et al.), and mutual exclusivity (Smith). Together, these chapters present a strong argument to complement empirical research on language evolution.

This is a wide-ranging book, which is given a tighter and necessary focus by its editor, and by the authors of the introductory sections; without these, the general reader would struggle to grasp an overall understanding of this cross-disciplinary field. While the book purports to appeal to a wide audience, in practice, it is to be expected that researchers would be drawn towards their particular area of interest, perhaps skimming over other contributions; thus, linguists would be drawn to the first theme, while computer scientists might be drawn to the fourth theme. While there is an overall unity to the book, the section on analogous and homologous traits in other species (although interesting) seems a little out of place, especially given the balance of chapters allocated to this theme. As is to be expected in a volume of this kind,

some authors' writing styles are more accessible than others' to the general reader. Some address the reader directly, and employ contractions; others take a more formal approach, and different readers will react to this in different ways. However, this is a timely volume which lives up to its aim of informing on the latest developments in what is considered to be a thriving cross-disciplinary field.

Jean Piaget (Robert L. Campbell, Ed. and trans.): Studies in reflecting abstraction. Psychology Press, Hove, England, 2001, 352 pp, H/b £49.95

Seán Ó Nualláin

A theory that can cater for cognition that is both symbolic and situated is one of the holy grails of Cognitive Science. The current difficulties are exemplified by the tension between the creators of Cog and other Rodney Brooks-type developers, whose products are situated and non-symbolic, and Lenat et al.'s limited forays in the symbolic direction with CYC and its ilk. The fact that CYC has been as underwhelming as it has transpired to be, despite the massive funding it received, certainly gives pause. Perhaps, as argued by several writers in the Benjamins "Two Sciences of Mind" collection (Ó Nualláin et al. 1997), consciousness has a role in higher aspects of language processing?

Many researchers believe that Piaget's massive oeuvre is an exhaustive search for the holy grail, with impressive use of the extremely limited tools at his disposal in continental Europe over 50 years ago. As a biologist, he followed Henri Bergson in characterising knowledge as a form of adaptation; as a philosopher and psychologist, he sought to distinguish the essential facts about knowledge from contingent incidents in its development within the individual. Though undoubtedly wrong in many of the details of his experiments, Piaget's work, in the opinion of his supporters, dwarfs any comparable intellectual edifice. Moreover, suitably transformed in work like Mark Bickhard's, it may yet provide a theory of cognition that is as symbolic as it is situated, as immune to the attacks of empiricists as of rationalists, and as savvy on the innatism issue as it is possible to be.

The crucial insight for cognitive science in Piagets' work is his notion of symbolic behaviour as emerging naturally. In particular, the cognitive subject abstracts from regularities in his interaction with the environment to form the structures that comprise mathematics and language (for many, then, Lakoff is a follower of Piaget). Such abstraction has several levels; abstracting a property of action coordination is reflecting abstraction, the subject of this book. Applying reflecting abstraction to itself affords reflected abstraction, which Piaget claims is necessarily conscious. What price an extension of cognitive science to allow these operations? (Ó Nualláin et al. 1997, Ó Nualláin 2002 at least begins the attempt).

One can hardly have a better introduction to Piagetian theory than Campbell's; he is attentive to every nuance. The main text itself is vintage Piaget, and as such an acquired taste. One for the university library.

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Andrea Tettamanzi and Marco Tomassini: Soft computing: integrating evolutionary, neural and fuzzy systems. Springer, Heidelberg, Germany, 2001, 327 pp, H/b € 52.95

Liam Maguire

Soft computing is a generic term for a range of computational intelligent methodologies that have emerged from differing paradigms but which have a unifying theme of accommodating imprecision and are motivated by how we process information. Currently, methodologies such as fuzzy logic, neural computing, evolutionary computing, machine learning, probabilistic computing and chaotic computing are viewed as the main constituents of soft computing. It is also becoming increasingly evident that these techniques are complementary and hybrid approaches (bilateral or trilateral combinations of the techniques) can overcome individual limitations and achieve synergetic effects through their integration. These developments are motivated by the intelligence of natural organisms and in particular represent the attempts by engineers and scientists to mimic, albeit crudely at present, this ability in computational algorithms. The significance of the area is demonstrated by the phenomenal number of academic publications over the last few decades and the emerging practical applications ranging from industrial process control through to consumer electronic products.

The book *Soft Computing: Integrating Evolutionary, Neural and Fuzzy Systems* provides a comprehensive introduction to the area of soft computing addressing three of the main constituents of this discipline: fuzzy logic, neural computing and evolutionary computing. The authors recognise that they have only included three of the main strands of soft computing as they have attempted to take a more pragmatic view by considering those problem solving approaches which can be readily hybridised. Indeed, the current literature further testifies to this strategy as most books in the area address a similar or restricted set of the methodologies and the majority concentrate on the above subjects. This is largely due to the maturity of these three paradigms and their acceptance and application well beyond the traditional bounds of engineering and computer science.

The book is primarily aimed at undergraduate students and practitioners in the field. The book is organised in a modular form which enable readers to select their own pathway through the chapters. The initial three chapters introduce the fundamentals to each of the three subject areas: evolutionary algorithms, artificial neural networks and fuzzy systems. Each chapter is given in tutorial form, presenting the reader with the core concepts of each subject and concluding with a discussion of a practical application. The material will be familiar to many academics in the area but would be very informative for the target undergraduate student market.

The next four chapters of the book concentrate on the integration of two of the above methods. For example chapter 4 addresses the emerging area of evolutionary design of neural networks in terms of the topology of the network, the inherent weights, the learning rules, the neural activation functions and data sets to be used for learning. This is an increasingly important area of research reflecting the bio-inspired rationale of a brains long-term development through species evolution rather than the short-term learning process during one's lifetime. This is of particular significance for hardware implementations of large networks where the conventional training approaches are impractical. Chapter 5 continues on a similar theme by describing the evolutionary design of fuzzy systems in terms of both the

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shape and form of the membership functions and in terms of the inherent fuzzy rules. Again this is a more recent research area although there are numerous practical applications typically in control and data mining. Chapter 6 describes the more established hybrid methodology of fuzzy neural networks outlining some of the major contributions in the area and concluding with example applications for their deployment. Chapter 7 provides the final co-operative system involving fuzzy evolutionary algorithms. This is closely related to the topic outlined in Chapter 5, but it presents the less well-known hybrid approach of using fuzzy systems to improve the performance of evolutionary algorithms. This is a relatively new strategy that attempts to incorporate a degree of imprecision and reasoning capability to increase the robustness and reduce the computational requirements of the evolutionary algorithm. This chapter could have been further improved with more practical examples to demonstrate the effectiveness of the approach.

One disappointing feature of this section of the book, is that it does not conclude with a chapter outlining the integration of all three techniques such evidenced by recent research activity in the areas of evolvable fuzzy neural networks or fuzzy evolutionary algorithms to train neural networks. This would have been a natural extension to the integration of the techniques and would have highlighted that such co-operative techniques are not restricted to simply bilateral hybrid approaches. The inclusion of such a chapter would have also further justified the title of the book; as all three techniques of the soft computing techniques would be integrated.

The book concludes with a chapter entitled natural parallel (soft) computing. At first this appeared to be a rather erroneous topic to conclude the book as hitherto the main focus of the book was on the integration of the various methodologies. The chapter is mainly concerned with implementation issues and in particular massively parallel implementations in hardware. However, the topic is extremely important and visionary as it recognises both the inherent parallelism of the intelligent techniques and the distributed processing capability in the natural world. This recognition emphasises the bio-inspiration prevalent throughout the book and concludes that the maximum potential of soft computing can only be realised by hardware and/or parallel processing implementations. As a result, this chapter sets the future challenges for realisations of soft computing methodologies.

Overall *Soft Computing: Integrating Evolutionary, Neural and Fuzzy Systems* provides a comprehensive and balanced overview of the three main methodologies within the area. The book emphasises their complementary nature and the practical benefits of their implementations in a co-operative manner. The academic content is well supported by informative practical examples and case studies. However, one of the drawbacks of the books, as a recommended textbook for teaching purposes, is that it should be closely related to a simulation environment. Such an alignment would enable all, or some of, the example case studies to be provided within this environment and the provision of additional problems within each chapter would improve the overall learning experience. However, as an advanced academic textbook it serves as a compact and informative account of soft computing and a good reference source for recent developments and publications in the area.

Seán Ó Nualláin (Ed.): Spatial cognition. John Benjamins Publishing Company, Amsterdam, The Netherlands, 2000, xvi + 364 pp, P/b US $97.00

Anita Greenhill

This book presents a rich collection of essays that draws upon spatial cognition to explore the notion of consciousness. The essays are representative of psychology, computer science, linguistics and geography and each discipline's respective efforts to grapple with the complex proposition regarding how people think and communicate about space. The book presents selected papers from the 1998 Mind III annual conference of the Cognitive Science Society of Ireland. The papers are scientific in their focus and include discussions relating to space in cognitive psychology, linguistics, brain science and philosophy.

Publishing a series of papers from a conference is always a challenge to its editors. They must present a broad range of theoretical positions while remaining true to the papers chosen to represent the conference's topic. The challenge is to present a coherent thread of thought between the papers. This book successfully tackles the issue of coherence by grouping papers into categories for the reader and by clearly defining their intended audience. The categories presented include epistemological issues, software applications, language and space, memory consciousness and space.

The epistemological issues included in the book present a series of papers that explore 'knowledge' in association with spatial cognition. This section explores a variety of research approaches that can be utilised to understand mental mapping and modeling. The majority of papers present different examinations or ways of examining and gaining insight into human understandings of their physical environment. The first of these papers explores spatial knowledge as a sexed position. The scientific discussion presented by G. Allen in *Men and Women, Maps and Minds: Cognitive bases of sex-related differences in reading and interpreting maps* explores that women and men read maps differently and even though there is overwhelming evidence from statistics that suggest there are cognitive differences between the sexes the exploration of this proposition is ignored. Allen's argument is interesting in its initial rationale, that is, that there *are* sex-related cognitive difference at all and that this science can somehow justify the reality of these differences. This proposition is confronting, particularly for women, as their spatial cognition is viewed as inferior in a number of ways to that of men. Unfortunately, Allen, in his acknowledgement that this is an underutilized approach to cognition, answers his own ontological quandary and the results of his study do little to convince the reader of the reality of sex-related differences. However, this paper should be acknowledged for its brave attempt to explore such a hotly contested area of research in any field. Cognitive mapping is further explored by M. Grobéty, M. Morand and F. Schenk in their paper, *Describers and Explorers: A method for investigating cognitive maps*. This paper is approached in an equally scientific manner. The authors examine cognitive mapping in rats and humans. They explore the processes of learning tasks in visually disconnected environments. They also provide a concise discussion that situates spatial cognition and spatialised behaviour within research. This paper is significant for the book in its presentation of spatial cognition and the ontological suppositions of interest to artificial intelligence. It also situates the central theme of cognition in relation to the majority of papers presented in the book. The authors succeed in their aim to clarify whether spatial cognition exists in animals.

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Within the epistemological component of the book are a number of papers exploring spatial theory and cognition that are more clearly geographical in their orientation. The paper presented by N. Gotts, *Describing the topology of Spherical Regions using the RCC Formulisation*, explores formal representations of spatial concepts from a computational perspective. This paper is theoretical in focus. Human spatial competence is explored within an in depth computational discussion. Gotts' heralds the topologic component of RCC calculus and first order logic spatial formalisation as the basis for human-like reasoning. The emphasis on computing applications is, however, more consistently explored within the next section of the book.

The second section of the book presents a variety of papers discussing specific software applications used in the exploration of spatial cognition. This section will be of interest to the artificial intelligence community also. P. Mc Kevitt's paper *Chameleon Meets Spatial Cognition* is representative of the approach followed by the majority of software application's discussed in the book. In this case it is a detailed analogy and discussion presented about the software application, Chameleon. This particular software application is a multimedia application that takes input from speech, text and visual images to enable interaction with a machine. The interaction assists in understanding the perceptual association of the person. The focus of the paper is to analyse the spatial relationship that people hold to their visual environment. The software applications explored cover areas such as temporal structures, environmental mapping and, once again, geographic spatial concepts.

The next section of the book explores language and space. The papers in the section tackle the complex relationship that spatial terminology and meaning hold in human cognition. From the artificial intelligence perspective these papers also represent a computational conundrum that fascinates and interests many academics. Although these papers represent cutting edge approaches to examining this complex area, few move beyond the simplistic structuring of the linguistic categorisation of word associations. The final section of the book presents a series of papers exploring memory, consciousness and space. There are three papers in this section and they primarily focus on mapping and exploring the structuring of the mind for spatial understanding.

This book, overall, is a useful and thorough presentation of the scientific component of studies into space. In this way it is extremely pertinent to those individuals utilising scientific and computational approaches for their research. However, this particular selection of papers neglects the presentation of theorists who argue that spatial readings must be extended beyond a bounded territorial view, that is primarily geographically oriented and must incorporate the experiences of daily life. For a full range of spatial explorations to be presented the interaction between humans and objects requires inclusion of a discussion of "spatiality" and human cognition. There are also a number of differing spatial configurations that are presented by social scientists that could be readily adapted to explore the theme of mind and space. Exploring cognition and "spatiality" as an association of *both* time and space is a further possibility.

The majority of papers presented in this book utilise a theoretical position that explores the spatial relationships of objects and human awareness. As a conscious construct the object is understood in terms of it existence and its connection to 'reality' and mathematical representation (Lefebvre 1991). The manner people spatially position objects in their day-to-day lives is conventionally understood in terms of a human focal point and the relationship between the object and the human. These perspectives are closely tied to Western notions of Humanism and the Cartesian object (Jones 1993). Reality is constructed via existing monolithic structures, those 'things' that dominate the spaces of daily life. Monolithic structures such as buildings, furniture, and other people can be critically presented as meaning-stabilizing

entities (Rosen et al. 1990). However, the existence of objects — in 'reality' — requires a human physical presence to determine social meaning. Elias (1978) quantifies 'spatiality' as a bounded existence, where space is an empty container that we always attempt to fill. When the individual is separated from the environment it constructs ego 'within', or 'inside', the individual, while the environment and society is 'outside' (Elias in Cooper 1989). A spatial description such as Elias's can be defined as static, placing time and all other social constructs in an arbitrary conceptual opposition to space (Laclau in Massey 1994).

Utilising alternative spatial theorist has been flagged in this book by A. Smith in his interesting article titled *Spatial Cognition Without Space*. In line with Smith's discussion, Lefebvre's spatial theory is useful as it allows a movement away from the focus of time-based analysis, be it structural or notional. A change in the theoretical emphasis of Elias and Giddens is necessary if the processing components of conducting research as the final arbitrator of meaning is to be enabled. In many of the papers in Spatial Cognition, space could inadvertently be seen as the dictator of meaning as it is prioritised above other social categories. As Foucault (1990), Lefebvre (1991) and other spatial theorists argue, space is a focal lens but it is not a dictator of meaning that can be used to explore all components of human interaction.

The spatial definition provided by Molotch (1993, p. 887) most clearly articulates the different spatial focuses that a variety of spatial studies can occupy:

> Space is not simply inherited from nature, or passed on by the dead hand of the past, or autonomously determined by 'laws' of spatial geometry as per conventional location theory. Space is produced and reproduced through human intentions, even if unanticipated consequences also develop, and even as space constrains and influences those producing it.

Psychology, geography and computational studies are predominantly based upon Cartesian theory that is the scientific/mathematical rules of geometry that extrapolates the socio/temporal relationship of the universe in a manner necessary for design (Woods 1996, pp. 279–292). It is Cartesian theory that provides an axis for understanding our 'reality' through a duality of time/space relationships. Soja (1989) argues, "that there is a realization that space now more than time hides things from us, that the demystification of spatiality and its veiled instrumentality of power is the key to making practical, political and theoretical sense of the contemporary era." Foucault (1993) extends this idea, by arguing for the privileging of space over time. Foucault (1993) contends "that intellectuals have a particular function when society is being modernized and rationalized by managers and experts: they are to remain critical of nostalgic, Utopian and overly abstract thought." He suggests that "material changes cannot be used to explain changes in subjectivity", and that "what matters is the fit between material reorganized space, life-practices, values and discourse" (Foucault 1993). The opposition to this reification of objects and artifacts in their material form indicates some of the alternative perspectives that could be pursued by the researchers in this book.

A complete exploration of human cognition and the interactions between humans and objects requires a discussion of "spatiality" and the differing spatial configurations that theorists can forward. "Spatiality" has an association to *both* time and space. How we spatially position objects in our day-to-day lives is conventionally understood in terms of a human focal point and the relationship between human cognition, the object and the human.

The majority of papers presented in this book utilise a theoretical position that explores the spatial relations of objects as external components of the environment while human awareness

is internalised. This book could benefit spatial theorists with a broader background beyond the sciences and who are interested in understanding spatial cognition by including a more socially oriented exploration of space and cognition including perception, conception and representation. Overall this book is a thorough presentation of a variety of studies that use a scientific approach into the studies of space. In this way it is extremely pertinent to those individuals utilising this particular approach for their research. However the focus of the book generally could benefit from those theories about space who argue that spatial readings must be extended beyond a bounded territorial view, that are primarily geographically oriented, so as to incorporate the experiences of daily life.

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Jennifer Washburn: University Inc.: The Corporate Corruption of American Higher Education. Basic Books, NY, USA, 2005, 326 pp, P/b $16.95

Seán Ó Nualláin

It is appropriate to begin a review of this disturbing book with a historical note. Universities originated from medieval monastic foundations, and the regalia worn at conferrings/commencements evoke these origins. For example, the monk's cowl we wear is for anonymous donations to alleviate our lives of poverty; the very notion of a commencement robe derives from an urge to equalise all conferees. In historical terms, faculty are the original university; only later did the administrative structure acquire an independent legal existence. In the US, of course, much of this early history is lacking; yet, as Ms. Washburn amply documents (the scholarship in this book is first-rate), the initial impetus to turn universities into training camps was deflected by a concern with the higher calling of tertiary education about a century ago. In tandem with this, university teachers' unions were set up, and the notion of academic tenure institutionalised.

Ms. Washburn points to the passing of the Bayh-Dole Act in 1980, and its subsequent amendment by the Reagan administration in 1983 and 1987, as a potential deathknell for acade mic freedom. For the first time, universities could patent federally funded research on a grand scale. The proliferation of offices for technology licensing (OTLs) at universities since then has been impressive, leading universities in countries like Ireland to change their leitmotifs to protection of IP. What is deeply surprising is that fully half of these OTLs make a loss.

Business cannot pass up the kind of opportunity that beckons when universities in prime city land offer them sweetheart deals. The most celebrated of these is the UC Berkeley offer to Novartis to grant Novartis first right to IP on one third of the department's discoveries, irrespective of the source of funding, for $25 million. An ex-employee of Sandoz, a previous incarnation of Novartis, Dr. Ignacio Chapela, was brought in to railroad the deal through. His refusal to do so, as is now clear, contributed to the university's decision to veto the recommendations arrived at by its own standard procedures, and to deny him tenure. This incident formed the inspiration for Ms. Washburn's first foray into this subject, "The Kept University", for the Atlantic Monthly in 2000.

Several other cases of academic fraud are highlighted. The Jesse Gelsinger case is the most egregious, and one wonders why only civil proceedings have been brought in this case. Gelsinger suffered from a mild form of a rare liver disease, but offered to act as a guinea pig in clinical trials of a genetic therapy so that children suffering from a more severe form could benefit from the data emerging. The research was headed by a Mr. James Wilson at the University of Pennsylvania. Neither Jesse nor his family were told that both the university and Wilson's private company Genovo stood to gain financially from any treatments arrived at. Nor were they told that several monkeys who had undergone the same gene transfer procedure had suffered adverse effects, including death. In a truly macabre twist, Wilson helped Jesse's father scatter Jesse's ashes when the inevitable happened and a courageous 18-year-old died due to corrupt academic and business practice.

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The case of Garry Nolan at Stanford does not plumb the same depths. His students David Zapol and Michael Rothenberg found that their research was being used in a presentation by Rigel, a company being run by Nolan. The research work was again focussed on a laudable goal; finding a cure for Aids. Washburn comments that the destruction of Zapol's academic career, and near-fatal stalling of Rothenberg's, arose from Nolan's unwillingness to keep his university and private affairs distinct. The subsequent bullying behaviour involving senior members of the Stanford administration is a disgrace to that institution.

Ms. Washburn dares at the end to propose some solutions; the creation of independent third-party licensing bodies, new conflict-of-interest legislation, and a new agency to monitor drug trials, which she credibly argues have become unsafe. Along the way she draws out the Nobel Laureate Kenneth Arrow's distinction between "rival" resources; those, which, like the paradigmatic example of a bar of chocolate, mean that more for me is less for you, and nonrival resources, the more opensource entities that can drive economic development for everybody. The latter, Arrow argues, should never be proprietary even on economic grounds alone. Such thinking is urgently needed as bodies like the OECD issue recommendations about university systems whereof they are utterly ignorant.

Much hope remains. Chapela has just been tenured, and his (in all senses) seminal work showing GM contamination in Mexican maize has been attested. A cursory websearch will show dozens of critiques of this research, including a group exposed by the Guardian as a front for GM businesses. In an unprecedented and highly dangerous step, Nature distanced itself from the publication of Chapela's paper on this subject. The previous GM martyr, Arzad Pusztai, was too old to take on the establishment, and suffered a heart attack from the stress involved. Chapela will be around for some time. The attempt in Ireland to do away with tenure by introducing "guilty until proven innocent" disciplinary procedures also came to nought, despite the minister for education's writing a blank cheque for university administrations to sexually harass and bully their staff and students, an activity that the Irish national media has confirmed they entered into with great enthusiasm. In the meantime, more enlightened members of the business community mourn the passing of the impetus in universities that allowed truly blue-sky research to go on. They will hopefully begin to put their money where their ideals are.